

Carrier Reel, Carriage Method Using the Carrier Reel, and  
Method for Manufacturing Electronic Device

BACKGROUND OF THE INVENTION

5 (i) Field of the Invention

The present invention relates to a carrier reel used for carrying a plurality of products, electronic components of, e.g., a semiconductor apparatus in particular, and to a carriage method using the carrier reel.

10 (ii) Description of the Prior Art

In case of carrying electronic components of, e.g., a semiconductor apparatus, there is adopted a carriage method by which a carrier tape which is a tape accommodating a plurality of electronic components therein are wound around  
15 the carrier reel and the carrier reel is fed to carry a plurality of electronic components.

The carrier reel used in this method has such a structure as that a flange portion consisting of two surfaces which is distanced from each other by a tape width and  
20 provided in parallel with and opposed to each other is connected to a hub portion provided between the two surfaces.

In the carriage method for electronic components adopting such a carriage method, after carriage, an axial rod is inserted into a through hole and the like provided in the  
25 center of a body portion of the reel to mount the carrier reel having the carrier tape wound around the reel on an automatic assembling line, and the individual electronic

components are supplied by drawing the carrier tape, thereby performing mounting and assembling of each electronic component.

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#### SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a carrier reel for carrying a plurality of electronic components, by which the volume of the entire package becomes constant irrespective of characteristics of the electronic components to be carried and to provide a carriage method using the carrier reel.

To achieve this aim, the present invention provides a carrier reel comprising: a flange portion having a first surface and a second surface which is opposed to and substantially parallel to the first surface; and a hub portion which is provided between the first surface and the second surface and connected to the flange portion, a carrier tape in which a plurality of electronic components are mounted being wound around the hub portion, accommodation portions accommodated a drying agent being provided to the hub portion.

In addition, the present invention provides a carriage method using the carrier reel comprising: winding a carrier tape in which a plurality of electronic components are mounted around a hub portion of a carrier reel which comprises a flange portion having a first surface and a second surface which is opposed to and substantially parallel

to the first surface and a hub portion which is provided between the first surface and the second surface and is connected to the flange portion, the hub portion having accommodation portions accommodated a drying agent provided thereto; accommodating the drying agent in the accommodation portions; and putting the carrier reel around which the carrier tape is wound into a bag, sealing the bag and performing carriage after accommodating the drying agent in the accommodation portions.

#### BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention, it is believed that the invention, the objects, features and advantages thereof will be better understood from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a cross-sectional view showing a carrier tape in a first embodiment according to the present invention;

Fig. 2 is a plane view of a carrier reel in the first embodiment according to the present invention;

Fig. 3 is a perspective view of the carrier reel in the first embodiment according to the present invention, taken along the line III-III in the plane view;

Fig. 4 is an inclined plane view showing a carriage

method using the carrier reel in a second embodiment according to the present invention; and

Fig. 5 is a schematic view showing a packaging method for electronic components using the carrier reel in the second embodiment according to the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments according to the present invention will now be described with reference to the accompanying drawings.

Figs. 1 to 3 are views showing a first embodiment according to the present invention. Fig. 1 is a cross-sectional view of a carrier tape wound around a carrier reel of this embodiment; Fig. 2, a plane view of the carrier reel; and Fig. 3, a cross-sectional view taken along the III-III line in Fig. 2.

Description will first be given as to the carrier tape wound around the carrier reel in this embodiment.

As shown in Fig. 1, a carrier tape 1 in which electronic components are accommodated is constituted by a carrier tape main body 1a and a cover tape 1b. Embossed pockets 3 which are concave portions are provided to the carrier tape main body 1a at predetermined intervals in the lengthwise direction. A chip type electronic component such as a capacitor or an LSI mounted on a printed board is accommodated in each embossed pocket 3. Particularly, in Fig. 1, a resin sealed type semiconductor device 2 which is easily

affected by humidity during carriage, e.g., a semiconductor device sealed by epoxy-based mold resin is accommodated. Further, the cover tape 1b prevents an electronic component accommodated in the embossed pocket 3 from coming off.

5 Figs. 2 and 3 are views showing a carrier reel in the first embodiment.

As shown in Figs. 2 and 3, the carrier reel in this embodiment is constituted by a pair of flat plate portions which is a flange portion 5 having a first surface and a  
10 second surface which is opposed to and substantially parallel to the first surface, and a drum portion which is a hub portion 6 to which the flange portion 5 is connected. A bearing portion 7 as a through hole which is supported by an axial rod of the automatic assembling line is formed in the  
15 center of the hub portion 6. To the bearing portion 7 is fixed the axial rod of the automatic assembling line provided in a direction vertical to the flange portion 5 consisting of the two surfaces after carriage of the reel. In this manner, the carrier reel of this embodiment is mounted on the  
20 automatic assembling line. In addition, drying agent accommodation portions 8 for accommodating the drying agent are provided to the hub portion 6 except the bearing portion 7. The carrier reel of this embodiment may be constituted by individual parts such as the flange portion or the hub  
25 portion or may be integrally molded.

Specifically, in this embodiment using the reel 4 having a reel external diameter A of 330 mm and a hub

diameter N of 100 mm, the rectangular drying agent accommodation portion 8 having the cross section of 25 mm x 50 mm is provided.

In the present invention, however, the cross section of the drying agent accommodating portion 8 does not need to have a rectangular shape, and it may have a sector form. Additionally, the present invention is characterized in that a large hollow portion of the hub portion 6 except the bearing portion 7 is utilized to provide the drying agent accommodating portion 8 for accommodating the drying agent. An opening portion is, therefore, provided to the flange portion and the entire hub portion 6 except the bearing portion 7 may be used as the drying agent accommodating portion.

Further, if moisture must be further assuredly prevented from entering, it is desirable to increase an amount of the drying agent accommodated in the drying agent accommodating portions 8 as much as possible. In other words, it is desirable that a maximum amount of the drying agent which can be accommodated is housed in the drying agent accommodating portions 8. Specifically, approximately 60 g of a clay-based drying agent is accommodated as the drying agent in the drying agent accommodating portions 8 in this embodiment. However, an amount of the drying agent to be accommodated is not limited to 60 g, and accommodating at least approximately 20 g of the drying agent can sufficiently prevent moisture from entering during carriage.

Since the carrier tape 1 accommodating therein a plurality of electronic components is wound in the later step, the diameter of the hub portion 6 usually takes such a value as that each accommodated electronic component can not be  
5 damaged. As a result, the diameter of the hub portion 6 is larger than the diameter of the bearing portion 7 which supports a shaft for packaging each electronic component, and a large hollow portion exists in the area of the hub portion 6 except the bearing portion 7.

10 In this embodiment, the drying agent accommodating portions 8 are provided by utilizing the hollow portion of the hub portion 6. Therefore, assuring only a cubic volume of the carrier reel suffices carriage of each electronic component which requires the drying agent during carriage,  
15 and the excessive volume for putting the drying agent is not necessary. Consequently, even in carriage of each electronic component which can be easily affected by moisture, an amount of the entered moisture can be reduced, and the carrier reel which does not have to increase the cubic volume of the  
20 entire package can be provided.

Further, in the first embodiment, as shown in Fig. 2, the drying agent accommodating portions 8 are so provided as to utilize the hollow portion of the hub portion 6 to the fullest extent. In this embodiment, therefore, a sufficient  
25 amount of the drying agent can be accommodated.

Additionally, in the first embodiment, the drying agent accommodating portions 8 are provided at positions

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symmetrical to the bearing portion 7. By arranging the drying agent accommodating portions 8 at positions symmetrical to the shaft portion 6, the weight balance relative to the axial rod becomes equable when the axial rod is inserted into the bearing portion 7 to mount the carrier reel on the automatic assembling line. As a result, the electronic component can be smoothly supplied. Even in the case where each electronic component is mounted or assembled after carriage by using the carrier reel, the assembling process of an electronic product can be consequently facilitated with the drying agent being accommodated. That is, in the present embodiment, the step and time for removing the drying agent from the drying agent accommodating portions 8 are not required.

It is to be noted that the shape of the drying agent accommodating portion 8 corresponds to the through hole in this embodiment but provision of a space in which the drying agent can be accommodated can suffice the present invention, and it does not have to be the through hole. Moreover, in the bearing portion 7, although this embodiment employs the through hole, the through hole does not have to be used. Mounting the reel to the automatic assembling line in the assembling step which is a post-process can suffice the present invention.

Further, in this embodiment, the carrier reel constituted by the flange portion 5 and the hub portion 6 is formed of, e.g., polystyrene or a recycling material having



the same quality. If the conductivity is required in the carrier reel 4, however, forming the carrier reel 4 by using polystyrene in which a carbon material is mixed as a conductivity giving agent can impart the conductivity to the carrier reel itself.

As described above, according to the present embodiment, providing the drying agent accommodating portions 8 to the hub portion 6 of the carrier reel 4 which carries a plurality of electronic components enables accommodation of the drying agent by exploiting the inside of the carrier reel 4, i.e., the hollow portion of the hub portion 6. Therefore, when carrying each electronic component which can be easily affected by moisture, the excessive cubic volume of the drying agent which has been conventionally required is no longer necessary.

In other words, using the carrier reel according to this embodiment requires not excessive cubic volume of the drying agent. Thus, when carrying each electronic component which can be easily affected by moisture and requires the drying agent, the same number of the electronic components can be carried in a space which is substantially the same as that in the case of carrying electronic components requiring no drying agent. Furthermore, since the volume of the package used for carriage becomes equal irrespective of packaging environment conditions for the electronic component to be carried, the package having the same size can be used.

A second embodiment according to the present

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invention will now be described with reference to the accompanying drawings. Figs. 4(a) and 4(b) are views of respective steps showing a carriage method using the carrier reel in the second embodiment according to the present invention.

A reel 4 having spaces portion for accommodating therein the drying agent such as described in connection with the first embodiment, i.e., drying agent accommodating portions 8 is first prepared. Subsequently, a carrier tape 1 which has been also described in conjunction with the first embodiment and is shown in Fig. 1 is wound around a hub portion 6 of the reel 4, and a plurality of electronic components are accommodated in the reel 4. As shown in Fig. 4(a), a drying agent 9 having a necessary amount is accommodated in each drying agent accommodating portion 8 of the reel 4.

Here, the specific dimension of each part and an amount of the drying agent to be accommodated are as described in the first embodiment.

As shown in Fig. 4(b), the drying agent 9 and the electronic component are put in a damp proof bag 10 together with the reel 4 accommodating them, and the damp proof bag 10 is sealed. Thereafter, the sealed damp proof bag 10 is put into a packaging material such as an inner box previously made of a paperboard so that packaging is performed. Further, these inner boxes are grouped and packaged by an outer box which is similarly made of a paperboard.

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A plurality of electronic components are finally carried in the state that they are packaged by these outer boxes.

After carrying the electronic components in this manner, as shown in Fig. 5, the carrier reel is mounted on the automatic assembling line with the carrier tape being wound around the carrier reel. At this time, the end of the carrier tape 1 is wound around a take-up reel 13.

Subsequently, each electronic component accommodated in the carrier tape, for example, a chip type electronic component such as a capacitor or an LSI is supplied to a printed board 12 and the like by a tool 11 by which drawing and vacuum absorption of the carrier tape are performed. After supply of each electronic component to the printed board, for example, solder reflow is conducted so that mounting of each electronic component on the printed board and assembling of an electronic product are executed.

In particular, if a semiconductor device sealed by resin is mounted in the carrier tape to be carried, using the carriage method of this embodiment can avoid such a problem as that, after carriage of the semiconductor device, the heat treatment such as solder reflow performed for mounting each semiconductor device on a board can prevent sudden cubical expansion of moisture entered in the package of the semiconductor device during carriage and generation of peeling or a crack on the package boundary face.

Furthermore, according to such a carriage method in

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the second embodiment, since the excessive cubic volume of the drying agent is not necessary, it is possible to carry the reels whose number is equal to that of the reels used for carrying electronic components requiring no drying agent. As  
5 a result, even in case of carrying electronic components which can be readily affected by moisture, a number of reels capable of carrying these components in a limited space can be increased. That is, a larger number of electronic components can be carried at the same time.

10 When the reel in which the drying agent accommodating portions 8 for accommodating therein the drying agent are provided at positions symmetrical to the bearing portion 7 is used, the weight balance relative to the shaft becomes equable in the assembling process for an electronic  
15 product using the automatic assembling line, and the post-process can be hence carried out without requiring the process for removing the drying agent. As a result, the electronic component can be assembled with the reduced labor and time.

20 It is to be noted that the above has described the carriage method by which the carrier tape is wound around the reel 4 and the drying agent 9 is then accommodated in each drying agent accommodating portion 8 in this embodiment.

25 In the present embodiment, there is used the carriage method by which the carrier tape is wound around the reel 4 and the drying agent 9 is then accommodated because the drying capability of the drying agent is improved as the

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time that the drying agent is open to the outside air is shorter. In order to educe the drying capability of the drying agent to the fullest extent, it is desirable that the drying agent 9 is accommodated in each drying agent

5 accommodating portion 8 after winding the carrier tape around the reel 4 and the reel 4 is immediately put in the damp proof bag 10 to be sealed.

In the present invention, however, the carriage method by which the drying agent 9 is accommodated in the  
10 reel 4 and the carrier tape is then wound around the reel 4 may be adopted, and the present invention is not restricted to this carriage method.

As described above, when the carrier reel according to the present invention is applied, since the accommodating  
15 portions for accommodating the drying agent are provided to the hollow portion of the hub portion, there is no need to provide an excessive space for the drying agent to be included even if electronic components which can be easily affected by moisture are carried. Therefore, the size of  
20 this reel can be the same as that of the carrier reel for electronic components which require no drying agent, and packaging materials such as common inner boxes and outer boxes can be utilized.

In addition, in the carriage method using the  
25 carrier reel according to the present invention, the space required for carrying one reel can be reduced even in cases where electronic components requiring the drying agent are

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carried. A plurality of electronic components can be consequently carried in the limited space.

If the reel in which the drying agent accommodating portions 8 for accommodating therein the drying agent are  
5 provided at positions symmetrical to the bearing portion 7 is used for carriage, the post-process can be performed without requiring the process for removing the drying agent in the assembling process for an electronic product using the automated assembling line.

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